

Laser Posterior Cordotomy: Is it a Good Choice in Treating Bilateral Vocal Fold Abductor Paralysis?

Mahmoud A. Khalil and Hazem M. Abdel Tawab

Faculty of Medicine, Cairo University, Cairo, Egypt.

ABSTRACT

BACKGROUND: Bilateral abductor vocal fold paralysis can lead to respiratory distress and dyspnea.

OBJECTIVES: To assess the efficacy of CO₂ laser unilateral posterior cordotomy in cases with bilateral abductor paralysis as regards improvement of dyspnea with preservation of satisfactory voice and swallowing after the operation.

METHODS: A prospective study was done on 18 patients with bilateral abductor vocal fold paralysis (10 females and 8 males) from November 2010 to December 2012 with their ages ranging from 32 to 64 years.

RESULTS: All patients showed improvement of dyspnea after the operation, most of the patients suffered from mild to moderate dyspnea in the immediate post-operative period, and two patients needed another intervention to solve it. All the patients had satisfactory results of their voice after the operation, and one patient only suffered from temporary aspiration.

CONCLUSION: Unilateral CO₂ laser posterior cordotomy is an easy and effective procedure to solve the dyspnea after bilateral vocal fold abductor paralysis without aspiration or significant voice alteration.

KEYWORDS: posterior cordotomy, satisfactory voice, dyspnea

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CORRESPONDENCE: hazemabdelawwab77@yahoo.com

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Introduction

Bilateral vocal fold paralysis is an uncommon problem that might lead to respiratory distress. Bilateral paralysis accounts for 25% of cases of recurrent nerve paralysis.¹ The most common cause of this condition is iatrogenic especially after thyroidectomy.² Causes include surgical trauma (44%), malignancies (17%), endotracheal intubation (15%), neurologic causes (12%), and idiopathic cases (12%).³ Surgical methods developed to treat this condition were aiming at reaching good respiration, phonation, and swallowing. Reviewing the literature showed that tracheostomy was, sometimes, the only solution for this condition.

Jackson introduced ventriculocordectomy in 1922, where he removed the entire vocal fold and the ventricle.⁴ In 1939,

King suggested extra laryngeal arytenoidectomy.⁵ Endoscopic arytenoidectomy has been developed in 1948.⁶ Surgery for this problem since then, passed through different modifications as laryngofissure arytenoidectomy with lateralization of the vocal fold by a suture⁷ and frank lateralization of the vocal fold with removal of amount of the thyroarytenoid muscle by laryngeal micro cautery.⁸

Ossoff et al in 1983 have mentioned the use of CO₂ laser in endoscopic arytenoidectomy.⁹ In 1989, Dennis and Kashima introduced laser posterior cordotomy to get good respiration results.¹⁰ All surgical procedures lead to breathy voice except reinnervation procedures. In this study, we were aiming to prove that laser posterior cordotomy is an effective and satisfactory procedure in treatment of bilateral vocal fold paralysis.

Methods

This prospective study was done from November 2010 to December 2012 in the Otorhinolaryngology Department, Faculty of Medicine, Cairo University, Egypt. Ethical approval for this study was granted and all patients gave their written, informed consent to participate. It was done on 18 patients including 10 females and 8 males with bilateral abductor vocal fold paralysis. Their ages ranged between 32 and 64 years. The number of bilateral vocal fold abductor paralysis cases included in this study was 16 cases after thyroidectomy and two idiopathic cases.

All the patients were given six months to one year time interval after the onset of bilateral vocal fold paralysis for the possibility of compensation or recovery.

All the patients presented with dyspnea grades II, III, or IV according to New York Heart Association scores (NYHA) and suffered from stridor during their sleep.

All the cases were subjected to full history taking to evaluate the cause and flexible laryngoscopic examination to assess the vocal fold mobility and to exclude the presence of masses. Pulmonary function tests were done, and CT scan with contrast was also done for all cases other than iatrogenic to exclude organic lesions.

All the patients were subjected to unilateral laser posterior cordotomy after taking their consents. The surgical procedure was done using microlaryngoscopy under general anesthesia with cuffed endotracheal laser tube after exclusion of cricoarytenoid joint ankylosis by a spatula. Cottonoids moistened with saline were put in the subglottis to protect the cuffed tube from the effect of laser. We used the CO₂ laser with micromanipulator in a super pulse mode.

Surgical technique. A 3.5–4 mm C-shaped wedge was excised from the posterior part of one vocal fold starting from its free border anterior to the vocal process and extending for 4 mm laterally over the false vocal fold (Fig. 1). This will create about 6 mm opening in the posterior part of the larynx (Fig. 2). The area is then moistened to remove the char, and a piece of cotton with 2 mL mitomycin-c (1 mg/mL) is applied.

Three of our patients were tracheostomized at the time seen before laser cordotomy. These cases had their tracheostomies done after thyroidectomy operation because of stridor.

All the patients received anti-reflux medications for three months after the operation.

The non-tracheostomized patients were instructed for voice rest for two weeks after the operation.

Follow-up was done for all patients for at least one year after the operation.

Results

This prospective study was done on 18 patients with bilateral vocal fold abductor paralysis, 10 females (55.5%) and 8 males (45.5%). Their ages ranged between 32 and 64 years with the mean age of 47.38 years and standard deviation of 8.56 years.

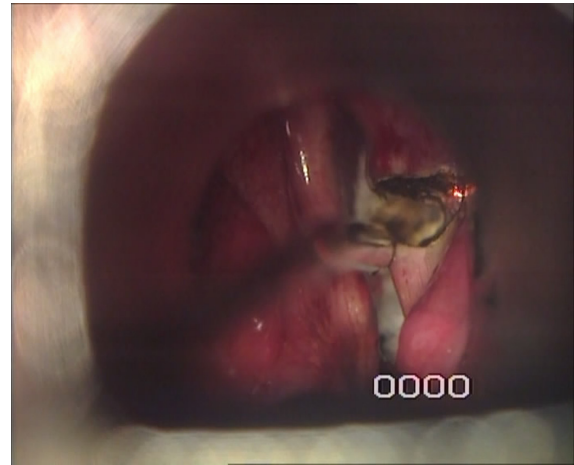


Figure 1. Procedure starting in front of the vocal process of the vocal fold.

The most common cause of bilateral vocal fold paralysis in this study was thyroidectomy (Table 1).

All patients were followed-up for at least one year after the operation for the following aspects: respiration, phonation, and swallowing.

Respiration. All patients except for the three tracheostomized patients were subjected to pulmonary function tests before and after one month of the operation. Post-operative pulmonary function tests were adequate for the daily routine activities as walking and doing minor work, but they were not satisfactory for the hard working activities as lifting heavy weights (grade I) (Table 2). The three tracheostomized patients had their tracheostomies removed within an average of one week after the operation.

All patients showed improvement of dyspnea after the operation except two patients (grade III) showed worsening of dyspnea (grade IV) for three weeks after the operation and needed a second intervention after failure of drug therapy as corticosteroids to alleviate their symptoms.



Figure 2. About 6 mm space created after the procedure.

**Table 1.** Data concerning the patients preoperatively.

CASE NUMBER	GENDER	AGE	WEIGHT/kg	BMI	ETIOLOGY	PRE-OPERATIVE TRACHEOSTOMY
1	Female	45	70	22.6	Thyroidectomy	+
2	Male	52	80	25.8	Thyroidectomy	-
3	Male	55	62	24.2	Idiopathic	-
4	Female	47	65	25.4	Thyroidectomy	-
5	Female	42	49	16.4	Thyroidectomy	-
6	Female	38	48	17.6	Thyroidectomy	-
7	Female	32	49	18.0	Thyroidectomy	+
8	Male	64	73	26.8	Thyroidectomy	-
9	Female	39	87	28.1	Thyroidectomy	-
10	Male	58	80	25.8	Idiopathic	-
11	Male	55	76	24.0	Thyroidectomy	-
12	Female	36	65	23.0	Thyroidectomy	-
13	Female	41	66	22.8	Thyroidectomy	-
14	Male	47	76	26.3	Thyroidectomy	-
15	Female	48	89	30.8	Thyroidectomy	-
16	Male	57	83	28.7	Thyroidectomy	-
17	Male	52	76	24.8	Thyroidectomy	-
18	Female	45	75	24.5	Thyroidectomy	+

Phonation. To assess the voice outcome after the operation, we used the subjective assessment of patients for their voices and the Voice Handicap Index (VHI after translation into Arabic language) after three months and one year of the operation. After three months, 10 patients presented with mild dysphonia (VHI under 30), six patients with moderate dysphonia (VHI 30–60), and two patients presented with severe

dysphonia (VHI 60–90). After one year, 16 cases with mild dysphonia and 2 cases with moderate dysphonia (Table 3). All the patients were satisfied with their voices after the operation.

Swallowing. All the patients did not complain from aspiration except one patient, who suffered from mild aspiration to fluids and showed complete resolution after three weeks and did not need any other interference.

Table 2. FEV1 before and after operation and the need for secondary intervention.

CASE NUMBER	FEV1 OF PREDICTED VALUE FOR AGE BEFORE OPERATION (FEV1/FVC < 0.7)	FEV1 OF PREDICTED VALUE FOR AGE AFTER OPERATION (FEV1/FVC < 0.7)	SECOND INTERVENTION
2	34%	55%	-
3	35%	58%	-
4	37%	55%	-
5	40%	67%	-
6	42%	70%	-
8	39%	30%	+
9	39%	30%	+
10	46%	67%	-
11	45%	70%	-
12	38%	57%	-
13	34%	59%	-
14	34%	56%	-
15	45%	65%	-
16	34%	68%	-
17	36%	72%	-

**Table 3.** VHI three months and one year after the intervention.

CASE NUMBER	VHI AFTER 3 MONTHS	VHI AFTER 1 YEAR
1	28	26
2	38	28
3	26	24
4	36	29
5	29	26
6	38	29
7	26	24
8	23	22
9	24	23
10	25	23
11	29	27
12	24	22
13	68	56
14	39	29
15	38	28
16	24	22
17	40	29
18	73	54

One complication met after the operation was the formation of vocal fold granuloma that decreased the space created for respiration in three patients; however, they did not need second intervention. Another complication was the temporary aspiration met in one patient after the operation.

Discussion

Unilateral posterior cordotomy is a short time procedure (about 15 minutes) for the treatment of respiratory difficulty after bilateral abductor vocal fold paralysis. Any procedure to treat this condition is better to be postponed for at least six months after the onset of paralysis for the chance of spontaneous recovery.¹¹ In 1989, Dennis and Kashima¹⁰ introduced posterior cordotomy. Endoscopic approaches have largely replaced the external approaches; however, some authors reported better results of the external techniques in their studies.¹² The super pulse effect of CO₂ laser gives more cutting effect and diminishes the heat produced thus reducing the edema and the need for tracheostomy after the procedure.¹³

Posterior cordotomy consists of a transverse incision of the vocal fold in front of its insertion into the vocal process. It should completely cut the elastic cone and reach the cricoid perichondrium.¹¹

Some authors extend the procedure to involve both vocal folds¹⁴ or to involve the vocal process of the cord.¹⁵ It is necessary to differentiate bilateral vocal fold abductor paralysis from cricoarytenoid ankylosis, which is mainly because of endotracheal intubation¹¹ or autoimmune disease.¹⁶

As regards respiratory outcome (88.9%) of the patients in this study were improved after the operation. Only two

patients (11.1%) did not improve and showed worsening of dyspnea that needed secondary intervention. In contrast to the literature studies, the improvement of dyspnea after the operation was 95%¹⁷ and 100%.¹⁸ However, the percentage of second intervention was 7%,¹⁸ reached up to 33% in the study done by Dennis and Kashima¹⁰ or 50%.¹⁷

Regarding the voice outcome, we used the VHI^{19,20} and the subjective assessment of patients for their voices. The subjective assessment was used in other studies too.^{17,21}

In this study, all of our patients were satisfied with their voices. Sixteen patients (88.9%) presented with mild or moderate dysphonia three months after the operation. After one year, 100% of patients presented with mild or moderate dysphonia. In contrast to our study, patients with mild or moderate dysphonia after one year of the operation were about 85%.¹⁸

In our series, only one patient complained from temporary aspiration after surgery, and the formation of vocal fold granuloma was seen in three patients and did not require revision surgery, and this is in contrast to Özdemir et al's study in which four patients suffered from formation of vocal fold granuloma and all of them needed second intervention.²²

Reviewing the literature as regards the comparison between arytenoidectomy and only posterior cordotomy did not show any significant differences; however, Lawson et al stated that arytenoidectomy resulted in subclinical aspiration, while posterior cordotomy did not lead to this problem after surgery.²³

Conclusion

Unilateral CO₂ laser posterior cordotomy is a simple and a rapid technique that can solve the dyspnea developing after bilateral abductor vocal fold paralysis. It produces satisfactory glottic space for respiration without aspiration and with mild to moderate dysphonia after the operation. This work assumes that unilateral CO₂ laser posterior cordotomy is an effective and satisfactory procedure in treatment of bilateral vocal fold abductor paralysis because of its safety, short operative time, satisfactory results, and low complication incidence.

Author Contributions

Conceived and designed the experiments: MAK. Analyzed the data: HMAT. Wrote the first draft of the manuscript: HMAT. Contributed to the writing of the manuscript: MAK. Agree with manuscript results and conclusions: MAK, HMAT. Jointly developed the structure and arguments for the paper: HMAT. Made critical revisions and approved final version: MAK, HMAT. All authors reviewed and approved of the final manuscript.

REFERENCES

- Leon X, Venegas MP, Orus C, Quer M, Marañillo E, Sanudo JR. Inmovilidad glótica: estudio retrospectivo de 229 casos. *Acta Otorrinolaringol Esp.* 2001;52:486–492.
- Tucker HM. Rehabilitation of the immobile vocal fold. In: Fried MP, ed. *The Larynx. A Multidisciplinary Approach*. 2nd ed. St. Louis: Mosby; 1996:209–218.
- Benninger MS, Gillen JB, Altman JS. Changing etiology of vocal fold immobility. *Laryngoscope.* 1998;108(9):1346–1350.



4. Jackson C. Ventriculocordectomy. A new operation for the cure of goitrous glottic stenosis. *Arch Surg*. 1922;4:257–274.
5. King BT. A new and function restoring operation for bilateral abductor cord paralysis. *JAMA*. 1939;112:814–823.
6. Thornell WC. Intralaryngeal approach for arytenoidectomy in bilateral abductor vocal cord paralysis. *Arch Otolaryngol*. 1948;47:505–508.
7. Downey WC, Keenan WG. Laryngofissure approach for bilateral abductor paralysis. *Arch Otolaryngol*. 1968;88:513–517.
8. Kirchner FR. Endoscopic lateralization of the vocal cords in abductor paralysis of the larynx. *Laryngoscope*. 1979;89:1779–1783.
9. Ossoff RH, Karlan MS, Sisson GA. Endoscopic laser arytenoidectomy. *Lasers Surg Med*. 1983;2:293–299.
10. Dennis DP, Kashima H. Carbon dioxide laser posterior cordectomy for treatment of bilateral vocal cord paralysis. *Ann Otol Rhinol Laryngol*. 1989;98:930–934.
11. Eckel HE. Lasers for benign diseases of the larynx, hypopharynx and trachea. In: Huttebrink KB, ed. *Laser in Otorhinolaryngology*. Stuttgart/New York: Thieme; 2005:102–104.
12. Bower CM, Sukgi SC, Cotton RT. Arytenoidectomy in children. *Ann Otol Rhinol Laryngol*. 1994;103:271–278.
13. Remacle M, Lawson G, Mayne A, Jamart J. Subtotal carbon dioxide laser arytenoidectomy by endoscopic approach for treatment of bilateral cord immobility in adduction. *Ann Otol Rhinol Laryngol*. 1996;105:438–445.
14. Khalifa MC. Simultaneous bilateral posterior cordectomy in bilateral vocal fold paralysis. *Otolaryngol Head Neck Surg*. 2005;132:249–250.
15. Manolopoulos L, Stavroulaki P, Yiotakis J, Segas J, Adamopoulos G. CO₂ and KTP-532 laser cordectomy for bilateral vocal fold paralysis. *J Laryngol Otol*. 1999; 113:637–641.
16. Landa M, Rodriguez L, Rivas A, et al. Obstrucción respiratoria aguda por artritis reumatoide laringea. *Acta Otorhinolaryngol Esp*. 1994;45:379–381.
17. Ferri E, García Purrinos FJ. Tratamiento quirúrgico endoscópico con laser diodo de la parálisis laringea en adducción. *Acta Otorhinolaryngol Esp*. 2006;57:270–274.
18. Landa M, Luqui I, Gomez J, Martinez Z. Posterior cordectomy. Our experience. *Acta Otorhinolaryngol Esp*. 2012;63:26–30.
19. Jacobson BH, Johnson A, Grywalsky C, et al. The Voice Handicap Index (VHI): development and validation. *Am J Speech Lang Pathol*. 1997;6:66–70.
20. Malki KH, Mesallam TA, Farahat M, Bukhari M, Murry T. Validation and cultural modification of Arabic voice handicap index. *Eur Arch Otorhinolaryngol*. 2010;267(11):1743–1751.
21. Khalifa MC. Simultaneous bilateral posterior cordectomy in bilateral vocal fold paralysis. *Otolaryngol Head Neck Surg*. 2005;114:599–604.
22. Özdemir S, Tuncer Ü, Tarkan Ö, Kara K, Sürmelioğlu Ö. Carbon dioxide laser endoscopic posterior cordotomy technique for bilateral abductor vocal cord paralysis: a 15-year experience. *JAMA Otolaryngol Head Neck Surg*. 2013;139(4):401–404.
23. Lawson G, Remacle M, Hamoir M, Jamart J. Posterior cordectomy and subtotal arytenoidectomy for the treatment of bilateral vocal fold immobility: functional results. *J Voice*. 1996;10:314–319.